

L138.941



# PATENT SPECIFICATION

DRAWINGS ATTACHED

L138.941

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## COMPLETE SPECIFICATION

### Improvements in and relating to Radial Flow Turbines

I, STUART SWINFORD WILSON, a British Subject of 17 Islip Road, Oxford, Oxfordshire, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to radial flow turbines and is concerned with the control of input to such turbines, or to one or more stages of such turbines if they are multi-stage radial flow turbines. The invention is particularly applicable to turbines in which the nozzle blades of the controlled stage(s) are of straight uniform section, but it will be evident that it is applicable also to turbines with other types of nozzle blade provided there is substantial uniformity of section.

In accordance with the invention there is provided a radial flow turbine wherein a set of blades of the or at least one stage of nozzles is provided with co-operating means having cut-outs or recesses or the like receiving, or adapted to receive, at least the end portions of the blades so that relative movement between said blades and said means lengthwise of the blades alters the area and/or shape of the flow passage through the set of blades, said relative movement being under the control of one or more bellows devices. It will usually be more convenient for the co-operating means to be movable relative to the blades, rather than the reverse; it is envisaged, however, that it may be desirable under certain conditions for both the co-operating means and the blades to be movable relative to each other. According to another feature of the invention, the input to the stage is controlled automatically by causing said relative movement in response to variations in one or more particular conditions, such as pressure and/or temperature of the fluid at output. Alternatively of course, arrangements may be such that both the co-operating means and the blades themselves, for example by means of a movable ring mounting

for the blades, are movable, each under separate control. In this way, the input power to the turbine may be controlled automatically. Moreover, such control has the advantage that there need be only one, or at least only one principal, moving part for effecting control of the entry conditions to the stage of the turbine and this may be controlled to give the best conditions for efficient operation of the turbine.

One embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, of which,

Figure 1 is a diagrammatic sectional view of an inward radial flow turbine and

Figure 2 is a diagrammatic sectional view along the line II—II of Figure 1.

Referring to the drawings, an inward radial flow turbine includes a rotor 1 mounted on a shaft 2 and located in a housing 3 with an inlet passage 4 and an outlet passage 5. One of the blades 6 of the rotor 1 is shown in Figure 1. A set of nozzle blades 7 located in the inlet passage 4 are carried by a ring 8 detachably secured to the housing 3. A movable ring 9 has a set of recesses 11 which co-operate with the nozzle blades 7, the free end portion of each nozzle blade 7 extending into a corresponding recess 11. An annular bellows 12 has one end secured to the movable ring 9 and its other end secured to a ring 13 detachably secured to the housing 3. A pipe 14 passes through the housing 3 to communicate with the interior of the bellows 12.

The movable ring 9 can be moved axially to vary the area of the flow passage between the nozzle blades 7. The bellows 12 and/or another spring will provide a force urging the movable ring to the left in the drawing, and gas pressure will be supplied to the interior of the bellows 12 through pipe 14 to control the position of the movable ring 9.

To reduce the effect of leakage through the working clearances between the nozzle blades 7 and the walls of the recesses 11, the recesses

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11 may be vented to the low pressure space between the nozzle blades 7 and the rotor 1, so that any such leakage is in the direction of flow rather than the opposite.

5 Although a series of bellows devices could be used instead of the single annular bellows shown, an advantage of the single annular bellows is that it forms a seal between the inlet passage 4 and the rotor 1; also only one pipe  
10 14 is required. The pressure difference across the walls of the annular bellows 12 need not be large since, by design, the pressure required inside the bellows 12 could be arranged to be approximately mid-way between the pressure  
15 in the inlet passage 4 and the pressure at the rotor inlet.

The invention is applicable, as will be evident to those skilled in the art, also to partial admission turbines.

20 It may be arranged that the blanking-off or other co-operating means is composed of two or more inter-related parts and possibly under the control of separate control means responsive to the same conditions. Two such means  
25 may be associated with the nozzle blades, one operating at each end of the blade so that the area of nozzle passage may be controlled, if necessary, according to variations in two conditions separately. Although this probably involves a duplication of control means, this  
30 need not detract from the simplicity of operation of the control.

35 Alternatively, when controlling in accordance with variations in two or more conditions, signals from means responsive to variations in the different conditions may be fed into a common means to produce a combined control signal; accordingly only the co-operating means or the blades need therefore be movable.

#### 40 WHAT I CLAIM IS:—

1. A radial flow turbine wherein a set of blades of the or at least one stage of nozzles is provided with co-operating means having

45 cut-outs or recesses or the like receiving, or adapted to receive, at least the end portions of the blades so that relative movement between said blades and said means lengthwise of the blades alters the area and/or shape of the flow passage through the set of blades, said  
50 relative movement being arranged to be under the control of one or more bellows devices.

2. A radial flow turbine as claimed in Claim 1 wherein said co-operating means are arranged to be movable relative to the blades.

3. A radial flow turbine as claimed in Claim 1 wherein both said co-operating means and the blades are movable relative to each other.

4. A radial flow turbine as claimed in any preceding claim, wherein the relative movement is adapted to be effected by variations  
60 in pressure of fluid at output so as to control the input to the stage.

5. A radial flow turbine as claimed in Claims 1 to 3, wherein the relative movement is adapted to be effected by variations in temperature of fluid at output so as to control  
65 the input to the stage.

6. A radial flow turbine as claimed in any preceding claim, wherein movement of the co-operating means are under the control of a  
70 movable ring mounting.

7. A radial flow turbine as claimed in Claims 1 to 5, wherein the blades themselves are arranged on a movable ring mounting for  
75 separate control.

8. A radial flow turbine as claimed in Claims 1 to 4 wherein both the co-operating means and the blades themselves are arranged for separate mounting on movable ring mountings, each ring being under separate control.  
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9. A radial flow turbine having a set of nozzle blades with co-operating means substantially as hereinbefore described with reference to the accompanying drawings.

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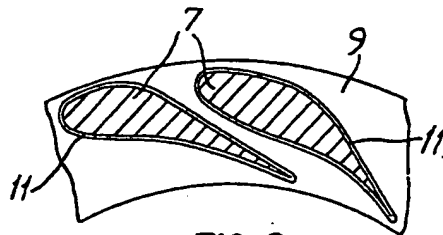
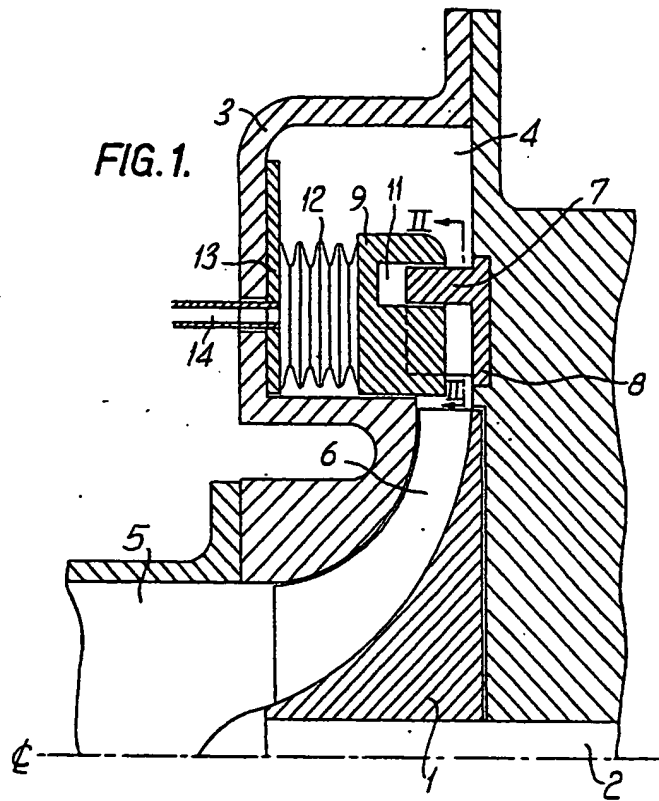


FIG. 2.